in the steam chest should be taken for the upper limit, as it would not be fair to debit the engine with losses in the steam pipes and stop valves, but losses through the ports are affected by the design, and should be charged against the engine. A drop of 10 to 15 Ib. should be allowed between the boiler and the engine steam chest. For the lower limit a reasonable back pressure above the condenser or the atmosphere should be assumed for inevitable losses in the exhaust ports, say i to 2 Ib. for non-condensing engines and 2 to 4 Ib. for condensing engines, and as these losses are affected by port and valve areas, as in the case of the high-pressure admission, high back pressures also should be regarded as an avoidable loss.

Cards from actual tests should be preserved, and the results, such as the drop from high-pressure steam chest to cylinder at admission, drop at the point of cut-off, and difference between actual back pressure on low-pressure cylinder, and pressure in exhaust pipe taken as near to the engine as possible, should be noted for future use.

The diagram factor having been obtained or assumed, it is then possible to fix the particulars of the high-pressure cylinder.

In order to obtain the diameter of cylinder, the cut-off must be fixed, bearing in mind the limitation imposed by ordinary valve gears previously referred to

If P_m = chosen mean referred pressure;
  P_c = steam-chest pressure;
  P£   = back pressure;
  R   = number of expansions = ratio, volume low-
      pressure cylinder/
      volume high-pressure cylinder at cut-off;

$$\text{then } P_m = \quad *\stackrel{\wedge}{\longrightarrow} - P_b$$

Values of - $\dfrac{\stackrel{\frown}{e}}{R}$ for varying values of R have been tabulated, and as the value of $\dfrac{P}{r_c} \quad \text{I} \cdot "p$ - is known for any given case, it is easy to find R from the table. If the cut-off in the high-pressure cylinder be decided and expressed as a fraction r, then the area of the high-pressure cylinder = area of low-pressure cylinder /Rr. An equal

distribution of power in the various cylinders is usually aimed at. To fix the cut-offs in the other cylinders from assumed clearance volumes, &c., from first principles is an exceedingly tedious and complicated process, and in practice reliable indicator cards from similar engines are carefully analysed.

Fig. 35 gives a diagram showing the full-load steam consumption to be expected from compound and triple- expansion engines of various sizes working with dry, i.e. saturated steam, and fig. 36 is a diagram showing the steam consumptions for the various loads for a triple-expansion engine of